able to presume that directly or indirectly it comes down as a feeder to winds that blow with equal constancy.

There certainly are winds that blow overland from polar towards tropical regions, but the tropical air that feeds the principal of these winds, flows, not in the higher regions, but on the surface of the ocean, passing from the tropics over the low level of the sea. In the Northern Atlantic southern winds blow between Ireland and Norway on the E., and Labrador and Greenland on the W., far into the Arctic Ocean, in their course parting with much vapour; and in the Northern Pacific western winds go far N. on the American coast, furnishing rain and snow. But these masses of air appear to return over continental lands, in both the old and new worlds, to regions of condensation in warm and moist parts. In the southern hemisphere winds blow eastward over the sea from the cold regions of Victoria Land to the rainy district about Cape Horn; but to the W. of Victoria Land, extending beyond the meridian of the Cape of Good Hope, the flow of air in the lower regions is represented by navigators as being towards the South Pole.

Condensation of vapour, by irregularly disturbing the atmosphere at various heights, puts the air in motion at those heights, making it ascend in one part, and it must come down in another. Some of the areas of ascension have been described, and a few of descent, but there are innumerable others spread over the surface of the globe, every hill or place where heavy rain falls being to some extent an area of ascent, with the wind that blows towards it coming directly or indirectly from a region of descent. The whole aerial ocean, to a considerable height, is thus kept in a state of motion and change; and the invisible elastic vapour which is sent into the atmosphere by evaporation in one part, comes down as rain in another. The different quantities of vapour condensed in equal times in different localities, and the elevations at which the condensation takes place, modify the movements of the air in various degrees, and in all conceivable ways, but the nature of the processes is always the same.

XVI.—*Remarks upon the Amount of Light experienced in high Northern Latitudes during the absence of the Sun.* By Captain SHERARD OSBORN, R.N., C.B., F.R.G.S., Officier Légion d'Honneur, etc.

Read, June 14, 1858.

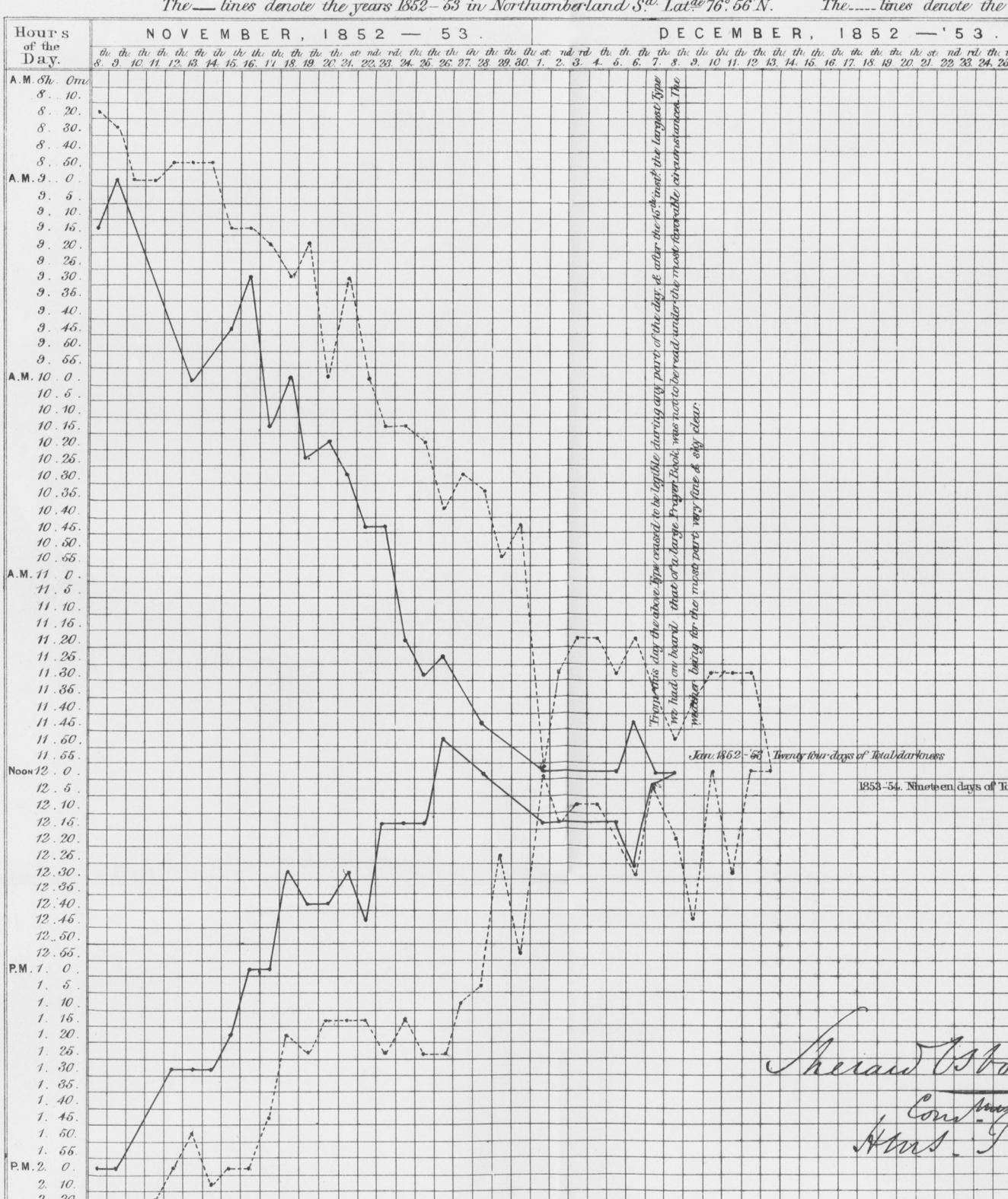
AFTER passing the winter of 1850-51 in H.M.S. *Pioneer* under the lee of Suffolk Island, in latitude 74½° N., I observed that discussions often arose as to the amount of light we Arctic navigators had really enjoyed during the past season of darkness, and that in

Specimen of the Type used

The English Funds have again remained throughout the day without any variation, except that towards the termination of business the market generally became more firm. Consols were first quoted 98⅝ to ¾, and at the close there were buyers at 98¾ for both money and account. India Bonds left off at 77s. to 80s., and Exchequer-Bills (June), 66s. to 69s., (March) 68s. to 71s. premium.

DIAGRAM, *Showing the amount of Daylight experienced during the absence of the Sun within*

The ___ lines denote the years 1852–'53 in Northumberland S^d. Lat^de 76°. 56'N. The ----- lines denote the



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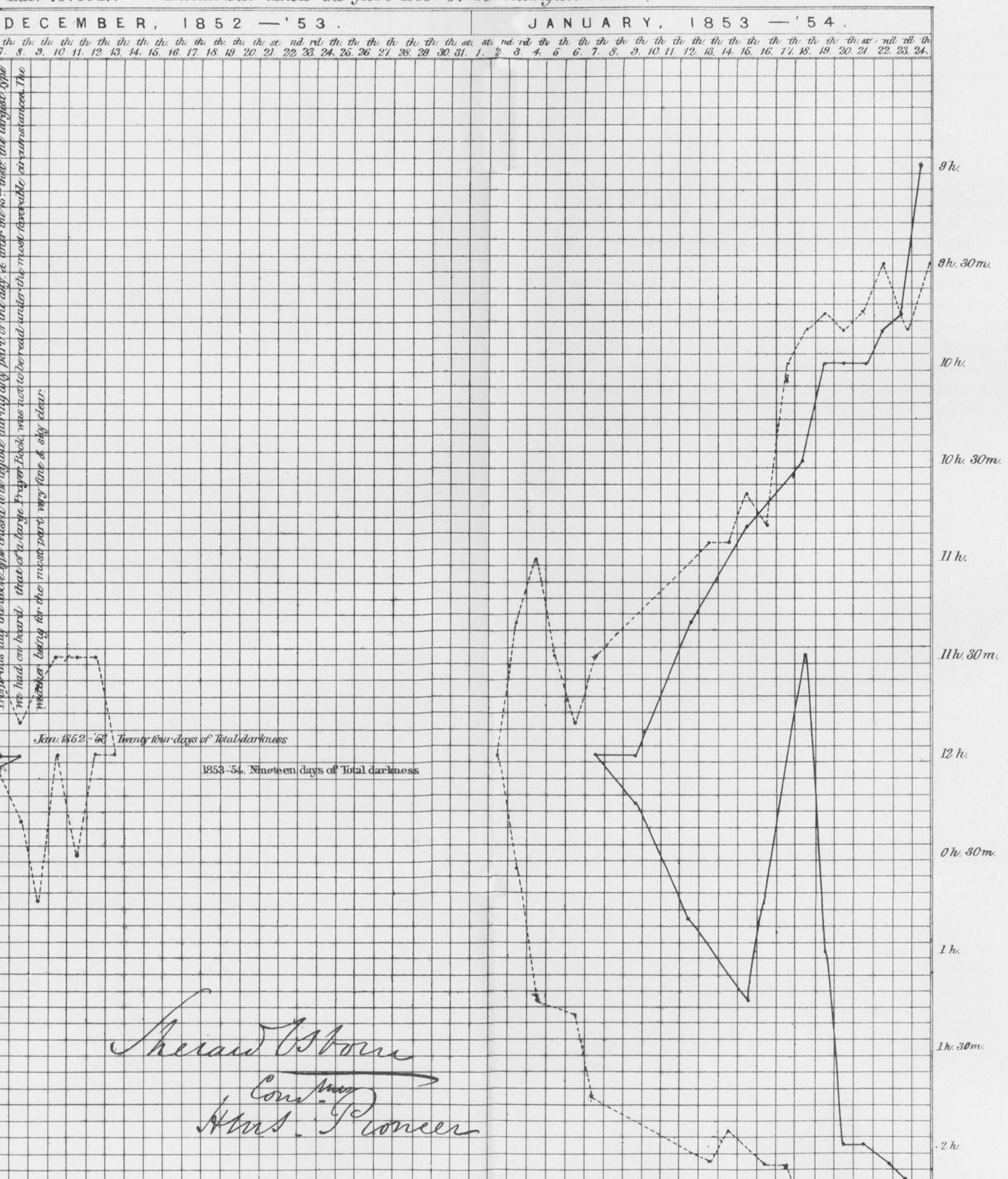
he day without any variation, except that to-
s the termination of business the market
ally became more firm. Consols were first
d 98⅝ to ¾, and at the close there were buyers
⅝ for both money and account. India Bonds
ff at 77s. to 80s., and Exchequer-Bills (June),
o 69s., (March) 68s. to 71s. premium.

as a Standard for Light.

during the absence of the Sun within the Arctic Zone in the Winters of 1852-53 and 1853-54.

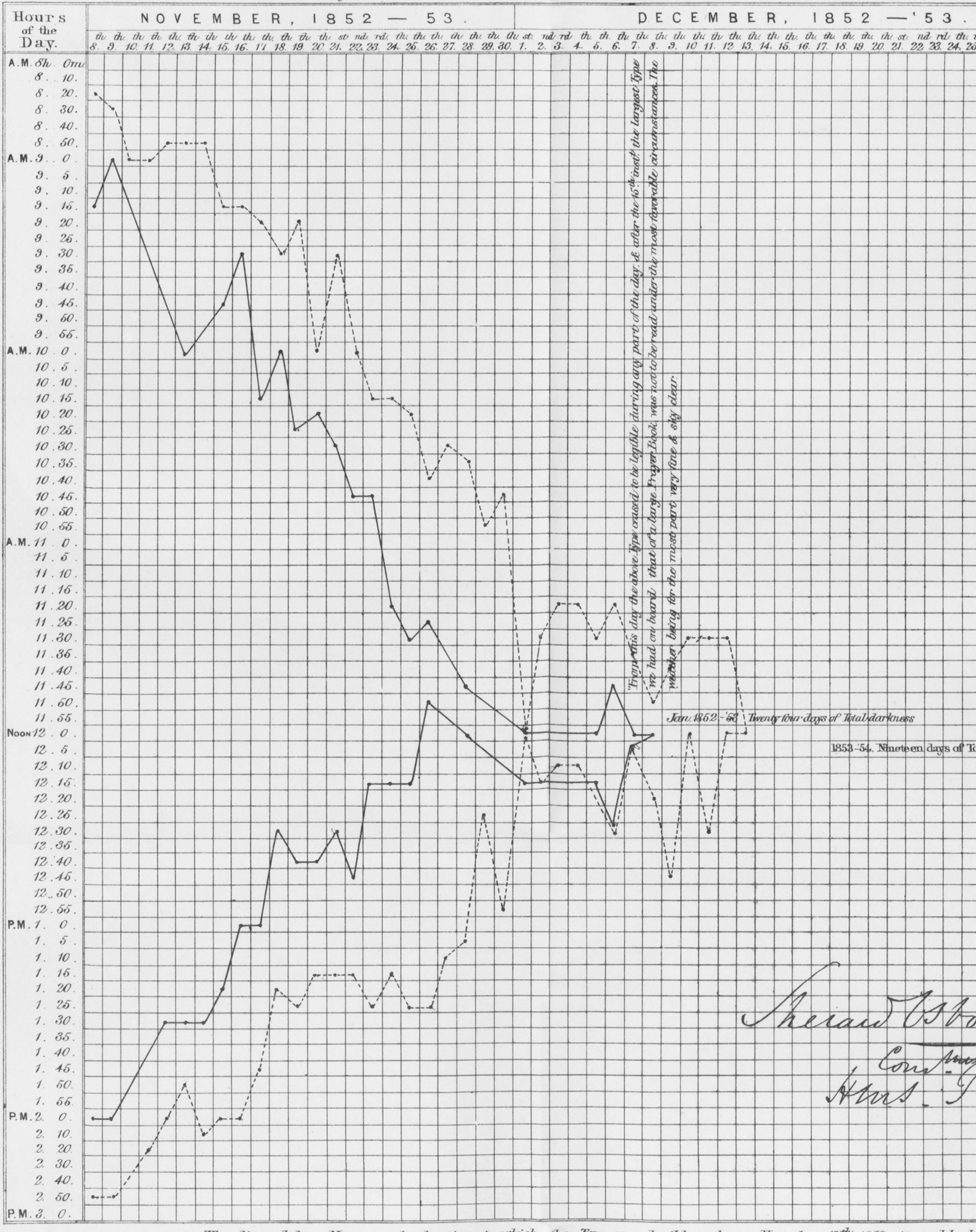
Lat^de 76° 56′ N. *The ----- lines denote the years 1853 '54 in Wellington Channel, Lat^de 75° 31′ N.*



left off at 77s. to 80s., and Exchequer-Bills (June), 66s. to 69s., (March) 68s. to 71s. premium.

DIAGRAM, *Showing the amount of Daylight experienced during the absence of the Sun within*

The — lines denote the years 1852–'53 in Northumberland S^{d}. Lat^{de} 76°. 56′N. *The ---- lines denote the*



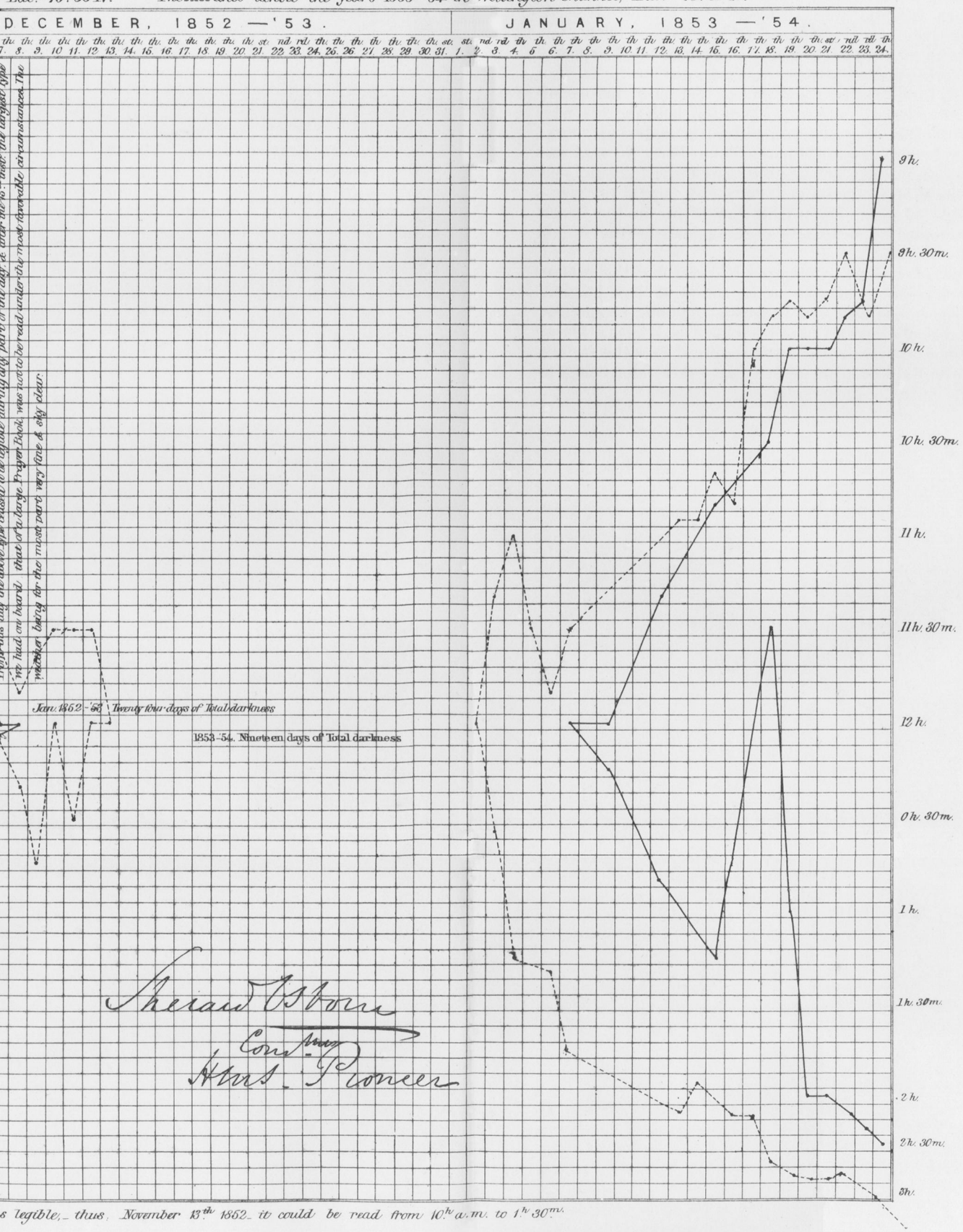
Hours of the Day.
NOVEMBER, 1852 — 53.
DECEMBER, 1852 — '53.
A.M. 8h. 0m.
A.M. 9. 0.
A.M. 10. 0.
A.M. 11. 0.
Noon 12. 0.
P.M. 1. 0.
P.M. 2. 0.
P.M. 3. 0.
From this day the above Type ceased to be legible during any part of the day, & after the 15th inst. the largest Type we had on board, that of a large Prayer Book, was not to be read under the most favorable circumstances. The weather being for the most part very fine & sky clear.
Jan. 1852–'53 Twenty four days of Total darkness
1853–'54. Nineteen days of To

* *The lines below Noon mark the time to which the Type was legible, _ thus, November 13th 1852_ it could b*

ff at 77s. to 80s., and Exchequer-Bills (June),
o 69s., (March) 68s. to 71s. premium.

during the absence of the Sun within the Arctic Zone in the Winters of 1852-53 and 1853-54.

Lat^de 76° 56' N. The ----- lines denote the years 1853 '54 in Wellington Channel, Lat^de 75° 31' N.



s legible,- thus, November 13th 1852- it could be read from 10h a.m. to 1h 30m.

England a vast amount of misconception existed as to what was the state of things in those latitudes during so prolonged an absence of the sun.

On my return to the Arctic Regions in 1852, I made arrangements not only for a most correct and impartial registry of the state of the weather and wind, but also that a registry of the amount of light should be kept.

The standard I selected as a test of light was the "Times" newspaper, as being pretty familiar type to all English eyes, and from its "Money Market Intelligence" I cut the fragment, of which a fac-simile is attached to the annexed diagram. My object was to ascertain during how many hours daily that type was legible upon the frozen surface of the sea, clear of the ship and of all shadow. The men selected for the work were three trustworthy petty-officers, who kept regular watch both by day and night; they were gifted with good sight, but nothing out of the usual course of things; they had no theories or crotchets to support, and consequently were most faithful in their observations.

The type was always placed facing the south, whence of course came the daylight we enjoyed; and the remarks upon the state of the sky, whether clear, misty, or cloudy, were recorded by me daily. It is hardly necessary to say that after our long night commenced, the amount of daylight which reached us depended considerably on a clear state of the atmosphere; but on looking at the diagrams made by the contracting light, it will be observed that it appeared to follow some general law in the two seasons, and diminished gradually day by day from November the 1st.

In lat. 76° 56′ N., that of Northumberland Sound, the standard type before referred to ceased to be legible after the 15th December during any time in the day, and it was not until the 9th of January, 1853, that it was again read during the brief space of 15 minutes.

Looking at the diagram line for 1852, we find that from the 6th November until the day of total darkness (December 15th), we in the *Pioneer* enjoyed in all 58 hours daylight, in which a person could have read the "Times" upon the open floe—or in other words, two days and ten hours daylight out of 39 Arctic winter days. The diagram for the following year, 1853, shows a slight improvement in this respect, for we there find that in latitude 75° 31′ N., or Wellington Channel, rather more than a degree farther south, although the date of total darkness agreed remarkably with that of the year 1852, yet between November 6th and December 14th we had had 4 days and 17 hours light, or nearly twice as much as in Northumberland Sound.

This may at first sight appear strange, but the cause is simply this:—In Northumberland Sound we should have had much more light but for the misty state of the atmosphere, occasioned by the

weakness of the ice in our neighbourhood, and the frost-smokes in the holes of water near us—holes which have been dignified with the names of "Polynias," or Open Arctic Seas; and but for those mists we should have had more daylight in November, although it is very probable the entire cessation of sunlight on December 15th would still have taken place. In the winter of 1852-53, in latitude 76° 56′ N. it will be observed that there was no sunlight whatever for the space of twenty-four days; and in that of 1853-54, in latitude 75° 31′ N., the same darkness existed for only 19 days.

With respect to that portion of the diagrams illustrative of the increase of light as the sun approached our Arctic horizon, it will be observed that the increase of light in both seasons was far more rapid than the decrease had been.

For instance, we find in 1853 that the daylight on January the 25th was already of 5½ hours duration. The declination of the sun would on that day have been about equal to what it was on the 19th November, 1852; but on that day we were only blessed with 2 hours 15 minutes daylight.

The corresponding 25th of January, 1854, in a more southern latitude, we had nearly six hours light; and on the corresponding day of the previous autumn, November 19th, 1853, only 4 hours 5 minutes of sunlight.

This rapid increase of the daylight in the spring of the Arctic regions is, in my opinion, owing to the absence of fogs, clouds, or mists at that season of the year. The rays of light are not impeded in their passage to the earth, and possibly the vast dome of snow and ice which at that season covers the Arctic zone serves to reflect and promote the diffusion of light: whereas in the autumn a totally different state exists; fogs, frost smokes, falling snow, and cloudy skies then prevail, and it is only wonderful that in 76° 56′ N. we should find any sunlight whatever fifty-three days after the sun has ceased to be visible.

The revivifying effects of returning light are most beneficial to both the animal and vegetable kingdom after the sore trial to which they have both been put during the period of total darkness and intense frost; and the rapid return of light to them cannot but be looked upon as another instance of the beneficent care of the Almighty for the work of his hands.

For farther details, I would refer the curious to the register attached to the diagram; and as it is the first attempt that has been made to place in a simple manner before the public the decrease and increase of light in the Arctic regions, I am in hopes it will be found in some measure interesting and instructive to the Society.

H.M.S.S. *Pioneer*.—Register of the amount of Daylight in Northumberland Sound during the absence of the Sun in the Winter of 1852-53.

Specimen of the Type used as a Standard for Light.

The English funds have again remained throughout the day without any variation, except that towards the termination of business the market generally became more firm. Consols were first quoted 98⅝ to ¾, and at the close there were buyers at 98¾ for both money and account. India Bonds left off at 77*s.* to 80*s.*, and Exchequer-bills (June), 66*s.* to 69*s.* (March), 68*s.* to 71*s.* premium.

Position. Latitude 76° 56′ N., Longitude 97°.

Date.	Period during which the above Type was legible. A.M.	P.M.	Total.	Daily Decrease.	Daily Increase.	Wind and Weather. Direction.	Force, &c.	Remarks.
1852.								
Oct. 27	The Sun was visible, owing to refraction; it was *actually* at noon below our horizon.							
	From h. m.	To h. m.	h. m.	Min.	Min.			
Nov. 6	9 0	2 10	5 10	..	..	Calm.	0, misty.	
Nov. 7	9 10	2 15	5 5	5	..	N.E.	3, misty.	
Nov. 8	9 15	2 0	4 45	20	..	N. by E.	1, cloudy.	
Nov. 9	9 0	2 0	5 0	..	15	N.N.W.	2, clear.	Heavy S.E. gale on 10th and 11th inst.
Nov. 12	9 45	1 30	3 45	75	..	S.E.	6, misty.	
Nov. 13	10 0	1 30	3 30	15	..	S.S.E.	4, misty.	
Nov. 14	10 30	1 30	3 0	30	..	S.E.	2, overcast.	
Nov. 15	9 45	2 20	4 35	A very clear day, with a peculiar reflection of light from the snow.				
Nov. 16	9 30	1 0	3 30	..	..	S.E.	3, misty.	
Nov. 17	10 15	1 0	2 45	45	..	S.E.	5, overcast.	
Nov. 18	10 0	0 30	2 30	15	..	S.E.	3, ,,	
Nov. 19	10 25	0 40	2 15	15	..	E.S.E.	1, ,,	
Nov. 20	10 20	0 40	2 20	..	5	S.E.	3, misty.	
Nov. 21	10 30	0 30	2 0	20	..	S.E.	6, overcast.	
Nov. 22	10 45	0 45	2 0	0	0	S.E.	6, misty.	
Nov. 23	10 45	0 15	1 30	30	..	S.E.	2.	The day was slightly cloudy, but the light was not interrupted by clouds.
Nov. 24	11 20	0 15	0 55	35	..	N.W.	3, misty.	
Nov. 25	11 30	0 15	0 45	10	..	N.W.	1, ,,	
Nov. 26	11 25 / 11 50	..	0 30	15	..	E.S.E.	overcast.	
Nov. 27	Too dark to read.			..	..	East.	1, misty.	
Nov. 28	Paper legible for 15′.			15	..	N.E.	4, clear.	
Nov. 29	Paper not legible.			..	..	N.W.	4, misty.	
Nov. 30	Ditto.			..	..	..	..	
Dec. 1	..	12 0 / 0 15	0 15	0	0	W.N.W.	3, misty.	
Dec. 2	and 3rd and 4th not legible.			..		E.N.E.	1, very clear.	
Dec. 5	12 0	0 15	0 15	0	0	Calm.	Very clear.	Qu. whether light was not auroral? (*Vide* Log.)
Dec. 6	11 45	0 30	0 45	..	30	Calm.	Very clear.	
Dec. 7	From this day the above type ceased to be legible during any part of the day; and after the 15th inst. the largest type we had on board, viz. that of a large Prayer Book, was not to be read under the most favourable circumstances, the weather being for the most part very fine and sky clear.							
1853.								
Jan. 9	12 0	0 15	0 15	0	15	S.E.	2, misty.	
Jan. 12	11 20	0 45	1 25	..	70	Variable.	1, clear.	
Jan. 15	10 50	1 15	2 25	..	60	E.N.E.	1, very clear.	
Jan. 18	10 30 / 11 30	..	1 0	85	..	..	,,	
Jan. 19	10 0	1 0	3 0	..	120	..	Very clear.	
Jan. 20	10 0	2 0	4 0	..	60	..	Very clear.	
Jan. 21	10 0	2 0	4 0	..	0	..	,,	
Jan. 22	9 50	2 10	4 20	..	20	..	3, misty.	
Jan. 23	9 45	2 15	4 30	..	10	..	Hazy.	
Jan. 25	9 0	2 30	5 30	..	60	..	6, misty.	
			Ceased to register.—*Vide* Log for the day.					

SHERARD OSBORN, *Commander*.

H.M.S.S. *Pioneer*.—Daily Register of the amount of Light during the absence of the Sun, in the Winter of 1853-54, the vessel being frozen in between Capes Osborn and Eden, on the eastern shore of Wellington Channel.

In Wellington Channel—Latitude 75° 31′ 15″ N., and Longitude 92° 21′ 55″ W.

Date.	Period during which the above Type was legible. A.M.	P.M.	Total.	Daily Decrease.	Daily Increase.	Wind and Weather. Direction.	Force, &c.	Remarks.
1853.	h. m.	h. m.	h. m.	Min.	Min.	True.		
Nov. 2	8 0	3 45	7 45	..	..	N.E.	4, misty.	
Nov. 3	8 15	3 40	7 25	20	..	North.	1, cloudy.	
Nov. 4	8 15	3 15	7 0	25	..	North.	1, misty.	
Nov. 5	8 30	3 0	6 30	30	..	Calm.	Very hazy.	
Nov. 6	8 30	3 0	6 30	0	..	N.W.	1, b. c.*	
Nov. 7	8 50	2 50	6 0	30	..	Easterly.	1, b. c. v.	
Nov. 8	8 20	2 50	6 30	..	30	E.S.E.	1, cloudy.	
Nov. 9	8 30	2 50	6 20	10	..	Calm.	4, overcast.	
Nov. 10	9 0	2 30	5 30	50	..	Westerly	5, gloomy.	
Nov. 11	9 0	2 25	5 25	5	..	Southerly	4, overcast.	
Nov. 12	8 55	2 5	5 10	15	..	S.E.	2, cloudy.	
Nov. 13	8 50	1 50	5 0	10	..	S.E.	1, clear.	
Nov. 14	8 55	2 10	5 15	..	15	N.N.E.	1, clear.	
Nov. 15	9 15	2 5	4 50	25	..	S.E.	1, clear.	
Nov. 16	9 15	2 0	4 45	5	..	Calm.	1, b. c.	
Nov. 17	9 22	1 45	4 23	22	..	N.W.	2, overcast.	
Nov. 18	9 30	1 20	3 50	33	..	S.S.W.	2, cloudy.	
Nov. 19	9 20	1 25	4 5	..	15	S.S.W.	3, b. c.	
Nov. 20	10 0	1 15	3 15	50	..	S.S.W.	6, snowing.	
Nov. 21	9 30	1 15	3 45	..	30	S.E. by S.	4, misty.	
Nov. 22	10 0	1 15	3 15	30	..	E.S.E.	3, b. c.	Stars of the 1st and 2nd magnitude visible at noon.
Nov. 23	10 15	1 25	3 10	5	..	S.E.	1, clear.	
Nov. 24	10 15	1 15	3 0	10	..	E.S.E.	1, b.	
Nov. 25	10 20	1 25	3 5	..	5	Calm.	0, clear.	
Nov. 26	10 40	1 25	2 45	20	..	N.W.	1, b.	
Nov. 27	10 30	1 10	2 40	5	..	N.W.	1, cloudy.	
Nov. 28	10 35	1 5	2 30	10	..	S.E.	1, clear.	
Nov. 29	10 55	0 20	1 25	65	..	S.W. by S.	3, overcast.	
Nov. 30	10 45	0 55	2 5	..	40	Calm.	Clear.	
Dec. 1	Able to read at noon only—snowing slightly.							
Dec. 2	11 30	0 15	0 45	80	..	N.W.	1, misty.	
Dec. 3	11 20	0 10	0 50	..	10	South.	1, b. m.	
Dec. 4	11 20	0 10	0 50	0	0	S.E.	2, clear.	
Dec. 5	11 30	0 15	0 45	5	..	S.E.	1, clear.	
Dec. 6	11 20	0 30	1 10	..	25	West.	1, b. m.	I think auroral light.
Dec. 7	11 35	0 10	0 35	35	..	Calm.	b. m.	
Dec. 8	11 50	0 20	0 30	5	..	S.E. by E.	5, clear.	
Dec. 9	11 40	0 45	1 5	0	35	Calm.	Very clear.	
Dec. 10	11 30	0 0	0 30	35	..	S.E. by E.	3, v. clear.	The daily decrease during the past week has been 2′ 8″; weather v. clear.
Dec. 11	11 30	0 30	1 0	..	25	S. by W.	1, v. clear.	
Dec. 12	0 0	0 0	..	..	..	S.E.	1, misty.	
Dec. 13	11 30	0 0	0 30	30	..	S.W.	1, misty.	
Dec. 14	Too dark to read at noon.							
Dec. 15								
Dec. 16	..	Very clear sky during these three days, but unable to read any type.						
Dec. 17	..							
Dec. 18	Sunday.							
Dec. 19								
Dec. 20								
1854.								
Jan. 3	11 20	12 30	1 10	..	70	S.E.	1, very clear.	
Jan. 4	11 0	1 15	2 15	..	65	S.E.	1, ditto.	
Jan. 5	11 30	0 0	0 30	35	..	S.E.	1, ,,	Snowing after noon.
Jan. 6	11 50	1 20	1 30	..	60	Calm.	Clear.	
Jan. 7	11 30	1 45	2 15	..	45	S.E.	2, clear.	Six days elapsed in the interim.
Jan. 13	10 55	2 10	3 20	..	65	S.E.	2, b.	
Jan. 14	10 55	1 55	3 0	20	..	Calm.	Misty.	Full moon.
Jan. 15	10 40	2 5	3 25	..	25	S.E.	1, misty.	
Jan. 16	10 50	2 10	3 20	5	..	E.S.E.	1, misty.	
Jan. 17	10 0	2 15	4 15	..	55	W.S.W.	1, fair.	
Jan. 18	9 50	2 45	4 55	..	40	S.E.	1, v. clear.	
Jan. 19	9 45	2 50	5 5	..	10	S.E.	1, clear.	
Jan. 20	9 50	2 55	5 5	0	0	Calm.	Clear.	
Jan. 21	9 45	2 55	5 10	..	5	Calm.	Misty.	
Jan. 22	9 30	2 50	5 20	..	10	W.S.W.	3, cloudy.	
Jan. 23	9 50	3 0	5 10	10	..	N.W.	3, overcast.	
Jan. 24	9 30	3 15	5 45	..	35	N.N.W.	4, clear.	
Jan. 25	9 20	3 10	5 50	..	5	West.	1, misty.	
Jan. 26	9 15	3 15	6 0	..	10	N.N.W.	1, clear.	
Jan. 27	9 10	3 15	6 5	..	5	S.E.	1, clear.	

Note.—It is remarkable that the proportion of light is greater after noon than before. I impute this mainly to the rays of light from S.E. to S. being intercepted by the land which extends in that direction.

* For explanation of the letters, *see* "Raper's Navigation," 6th edition, p. 134.—ED.

SHERARD OSBORN, *Commander*.